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Short communication

Antibacterial activity of some indigenous plants used for the treatment of wounds in the Eastern Cape, South Africa

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Abstract

The use of medicinal plants in the world, and especially in South Africa, contributes significantly to primary health care. This paper presents the findings of an initial survey of plants used for the treatment of wounds in the Eastern Cape Province, South Africa. Ethnomedical information gathered from surveys at clinics, hospitals as well as interviews with traditional healers and rural dwellers has revealed that *Grewia occidentalis*, *Polystichum pungens*, *Cheilanthes viridis* and *Malva parvifolia* are the most commonly used plants for the treatment of wounds in the province. The methanol extracts of *G. occidentalis*, *P. pungens* and *C. viridis* showed significant inhibition against gram-positive and gram-negative bacteria, while the acetone extract of *P. pungens* inhibited the gram-positive bacteria only. Extracts from *M. parvifolia* did not show any antibacterial activity at 5.0 mg/ml. Generally, the antibacterial property of the plants appears to have justified their use for the treatment of wounds, which are contaminated through bacterial infection, in the province.

Keywords: Antibacterial; Extract; Traditional medicine; Wounds

1. Introduction

The indigenous people of South Africa, for centuries, have relied on herbal medicine for all aspects of their primary health care. It is estimated that between 12 and 15 million South Africans still use traditional remedies from as many as 700 indigenous plant species (Meyer and Afolayan, 1995). Although many rural communities now have access to mobile clinics and hospitals, there is still, to a large extent, the belief in herbal medicine, possibly due to an inherent distrust in anything Western. Although free health care has become entrenched in South Africa's constitution, many rural people still rely on the cheaper traditional healing methods rather than the expensive treatments by Western practitioners.

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In this paper we report on the information collected from traditional healers, or *Sangomas*, on some of the most prominent plants used for the treatment of wounds in the province. We also report on the antibacterial property of *Grewia occidentalis* L., *Malva parviflora* L., *P. pungens* (Kaulf.) Presl. and *Cheilanthes viridis* (Forsk.) Swartz which, according to the information gathered, are the four commonest species used for wound treatment in the Eastern Cape. Suffness and Douros (1979) have observed that the choice of plants for bioprospecting based on ethnomedical information has yielded much higher potential for antimicrobial and medicinal property than random selection of plants. Hence, based on the information gathered, these four plants were chosen for further studies.

1.1. Ethnomedical information obtained from the Sangomas

G. occidentalis (Tiliaceae), cross-berry, is a shrub which is widely distributed throughout the Gauteng, Kwazulu Natal and Eastern Cape provinces. It is found in a variety of habitats from mountain slopes to thornveld and from wooded areas to the more arid highveld (Roberts, 1990). It was reported to be a widely-used medicinal plant. For example, the Zulu, Tswana and Xhosa peoples of South Africa soak the bark and small twigs in hot water and use the extract as a wash and lotion on wounds. Another member of this genus, *G. flava*, is also used as a wash to treat scratches and rashes (Roberts, 1990).

M. parvifolia belongs to the family Malvaceae. It is a prostrate or decumbent perennial herb, with a deep strong tap root system. A native of Europe, it has become a cosmopolitan weed species found in gardens and waste places and is common throughout South Africa and Namibia (Henderson and Anderson, 1966). From the information collected, traditional healers grind the leaves and stems of *M. parvifolia*, with or without the addition of heated brown sugar, and apply this as a hot poultice to wounds and to draw boils.

P. pungens (Aspidiaceae) is a fern which is endemic to South Africa (Jacobsen, 1983). It is found in the moist eastern and southern parts of the country from the Gauteng to the Southwestern Cape provinces. Dried fronds of *P. pungens* are pulversised and the powder sprinkled on wounds. The fresh fronds are also ground and applied as a poultice.

C. viridis is a member of the family Adiantaceae. It is a drought-resistant fern which is extremely variable in the size of the plant and the shape of the lamina. It is one of the most common ferns in southern Africa (Jacobsen, 1983). It grows mostly at altitudes between 700 and 1200 m, along wet forest edges, in dry or riverine forests, or in pine and *Eucalyptus* plantations. Like *P. pungens*, *C. viridis* fronds are dried and ground, and the powder sprinkled on wounds. The crushed fronds may also be applied as a poultice.

1.2. The study area

The Eastern Cape Province, South Africa, falls within the latitudes 30°00′–34°15′S and longitudes 22°45′–30°15′E. It is bounded by the sea in the East and the drier Karroo (semi-desert vegetation) in the West. The elevation ranges from sea-level to approximately 2200 m in the north of the province.

2. Methodology

2.1. Ethnomedical information

Information was compiled through questioning the local users using a questionnaire. Healers and villagers, including the *Sangomas* were especially helpful and were among those who provided the ethnobotanical information for this study. Clinics and hospitals were visited, with doctors and many nurses providing information regarding their knowledge of the local plants used in traditional medicine.

2.2. Collection of plant material

Plant shoot material (excluding flowers) was collected from natural populations throughout the

Eastern Cape Province and were identified using the herbarium at the University of Fort Hare (UFH). Voucher specimens of the plants (Grierson Med 98/1, 98/2, 98/3 and 98/4) were prepared and deposited at the Giffen Herbarium, UFH.

2.3. Preparation of the extracts

Adopting the modified methods of Meyer and Afolayan (1995) and Afolayan and Meyer (1997), 50 g portions of the plant material were separately homogenized in acetone and methanol. In the case of the water extract, the same amount of material was boiled for 5 min under reflux and cooled. (The method of extraction differed for water because the traditional healers mostly boil the plants without homogenization). The extracts were filtered (Watman No.1 filter paper), evaporated to dryness under reduced pressure, and later redissolved in their respective solvents to the required concentrations.

2.4. Preparation of agar-extract plates

Nutrient agar (Oxoid) was prepared in the usual fashion by autoclaving, and allowed to cool to about 60°C before the addition of the extracts. The agar medium containing the extracts at final concentrations of 0.1, 0.5, 1.0 and 5.0 mg/ml was poured into Petri dishes, swirled carefully until the agar began to set and left overnight for the solvents to evaporate (Afolayan and Meyer, 1997). Agar plates containing 0.5 ml of either acetone, methanol or water were used as controls respectively. Each test was replicated three times.

2.5. Bacteria

Ten bacteria species were collected from the Department of Microbiology and Plant Pathology, University of Pretoria, making sure that five were gram-positive and five gram-negative. Each organism was maintained on a nutrient agar plate (Oxoid) and was recovered for testing by growth in nutrient broth (Oxoid) for 24 h. Before streaking, each culture was diluted 1:100 with fresh sterile nutrient broth.

2.6. Antibacterial testing

The organisms were streaked in radial patterns on the agar plates (Mitscher et al., 1972; Afolayan and Meyer, 1997) and incubated at 37°C for 24 to 48 h. Complete suppression of growth was required for an extract to be declared active.

3. Results and discussion

The acetone extract of *P. pungens* inhibited the five gram-positive bacteria (Table 1). No inhibition, however, was observed from the acetone extracts of the other three plants.

The methanol extracts of *G. occidentalis*, *P. pungens* and *C. viridis*, inhibited the growth of both the gram-positive as well as the gram-negative bacteria, with the exception of *P. pungens* which did not inhibit *E. coli* at 5.0 mg/ml, the highest concentration used. Similar observations were reported by Rabe and Van Staden (1997) on water and methanol extracts from 21 South African plant species, who found that the majority of the antibacterial activity observed was in the methanol extracts. Traditionally, plant extracts are prepared with water as infusions, decoctions and poultices, therefore it would seem unlikely that the traditional healer is able to extract those compounds which are responsible for activity in the methanol extracts.

The water extract of *C. viridis* inhibited the gram-positive bacteria, as well as two gram-negative bacteria, *E. cloacae* and *P. aeruginosa*. In *P. pungens*, the water extract showed activity against four of the gram-positive bacteria and *E. cloacae*. Only two species of bacteria, *S. aureus* and *E. cloacae*, were inhibited by the water extract of *G. occidentalis* (Table 1).

The general antibacterial property of *G. occidentalis*, *P. pungens* and *C. viridis* appears to have justified their usage for the treatment of wounds (especially those with bacterial infection) by the indigenous people of the Eastern Cape. The inability of extracts from *M. parvifolia* to demonstrate any visible activity against any of the bacteria tested is, however, noteworthy. This is probably due to the low concentration of the

Table 1
Antibacterial activity of the acetone, methanol and water extracts of *G. occidentalis* (GO), M. *parvifolia* (MP)*, *P. pungens* (PP) and *C. viridis* (CV) shoots

Bacteria species	Gram +/−	MIC (mg ml^{-1})[a]								
		Acetone			Methanol			Water		
		GO	*PP*	*CV*	*GO*	*PP*	*CV*	*GO*	*PP*	*CV*
Bacillus cereus	+	na[b]	0.5	na	1.0	0.5	1.0	na	5.0	1.0
Bacillus pumilus	+	na	0.5	na	4.0	1.0	5.0	na	na	5.0
Bacillus subtilis	+	na	0.5	na	4.0	1.0	5.0	na	5.0	5.0
Micrococcus kristinae	+	na	1.0	na	4.0	1.0	5.0	na	5.0	1.0
Staphylococcus aureus	+	na	1.0	na	1.0	0.5	1.0	1.0	0.5	1.0
Enterobacter cloacae	−	na	na	na	4.0	5.0	5.0	5.0	5.0	5.0
Escherichia coli	−	na	na	na	4.0	na	5.0	na	na	na
Klebsiella pneumoniae	−	na	na	na	4.0	5.0	5.0	na	na	na
Pseudomonas aeruginosa	−	na	na	na	4.0	5.0	5.0	na	na	5.0
Serratia marcescens	−	na	na	na	4.0	5.0	5.0	na	na	na

[a] Minimum inhibitory concentration.
[b] Not active.
* All the extracts from *M. parvifolia* were not active against any of the bacteria tested.

extracts (5.0 mg/ml) being the maximum concentration tested in the experiment), unlike the traditional herbal practitioners who apply the extracts with no upper limit to their concentration.

Work is in progress on the isolation and identification of the antibacterial compound(s) in these plants.

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